2-1 General

This chapter discusses basic considerations related to the planning of Service Schools for inclusion in MCA programs, and consideration related to the design and review of such facilities. The material which follows is intended to establish general requirements and criteria within which to discuss special considerations, individual space criteria and space organization principles in the following chapters.

2-2 Army Training Program

A. Functional Requirements.
Army Training Programs are established to assist personnel in developing their job skills, intellectual leadership abilities, and their overall career potential. The composition and the size of the training program needed in each particular case is the basis for delineating the functional requirements for a Service School Facility.

B. Mission.
The mission of a typical U.S. Army Service School includes:

(1) Training:
Resident instruction and training in specific aspects of U.S. Army doctrine, policy, and procedures and in the maintenance, operation, and employment of selected items of Army equipment.

(2) Training Literature:
Developing, producing, and reviewing both school-related and Army-wide training literature.

(3) Doctrine:
Developing doctrine for the branch of the Army served by the school and participating in force development activities which affect that branch.

C. Instructional Program.
AR 351-1 identifies the various kinds of instructional programs offered by Army Service Schools. Some of the important courses offered are described below. Specific information concerning the schools and courses offered may be found in DA PAM 351-4, U.S. Army Formal Schools Catalog.

(1) Professional Development Course:
This course is designed to prepare commissioned officers, warrant officers, and non-commissioned officers to effectively perform the duties required in assignments of progressively greater responsibility. It usually includes instruction in military operations, resource management, and leadership. Such courses generally require from 3 to 9 months to complete.

(2) SW Progression Course:
This course is designed to train military personnel, usually lower grade enlisted personnel, in skills related to a specific military occupational specialty (MOS). Such courses normally require from 3 weeks to 3 months to complete.

(3) Functional Course:
This course is designed to enhance the effectiveness of military personnel in selected functional areas, for example, in the maintenance or operation of particular items of Army equipment. Such courses generally require from 1 to 4 weeks to complete.

D. Student Participants.
The following categories of personnel are eligible to attend Army schools and Defense schools operated by the Army:

(1) Active Army personnel.

(2) Active duty personnel of the other services.

(3) Personnel of the Reserve Components of all services.

(4) Military students from foreign countries participating in the Security Assistance Program, or from other friendly foreign countries when such training is determined to be in the best interests of the United States.

(5) Civilian personnel employed by the services and by other U.S. local, State and Federal governmental agencies, on a space-available basis.

(6) Civilian personnel of industrial or research organizations under contract to the U.S. Government when such training is not otherwise available and is deemed essential for fulfillment of the contract.

E. Staff Assignment.

(1) Organization.
The general staff organization of U.S. Army Service Schools is depicted in Figure 2-1. This chart is a guide only; the internal organization of staff elements varies between schools as necessary to meet their respective missions, areas of emphasis, workload and operating conditions.

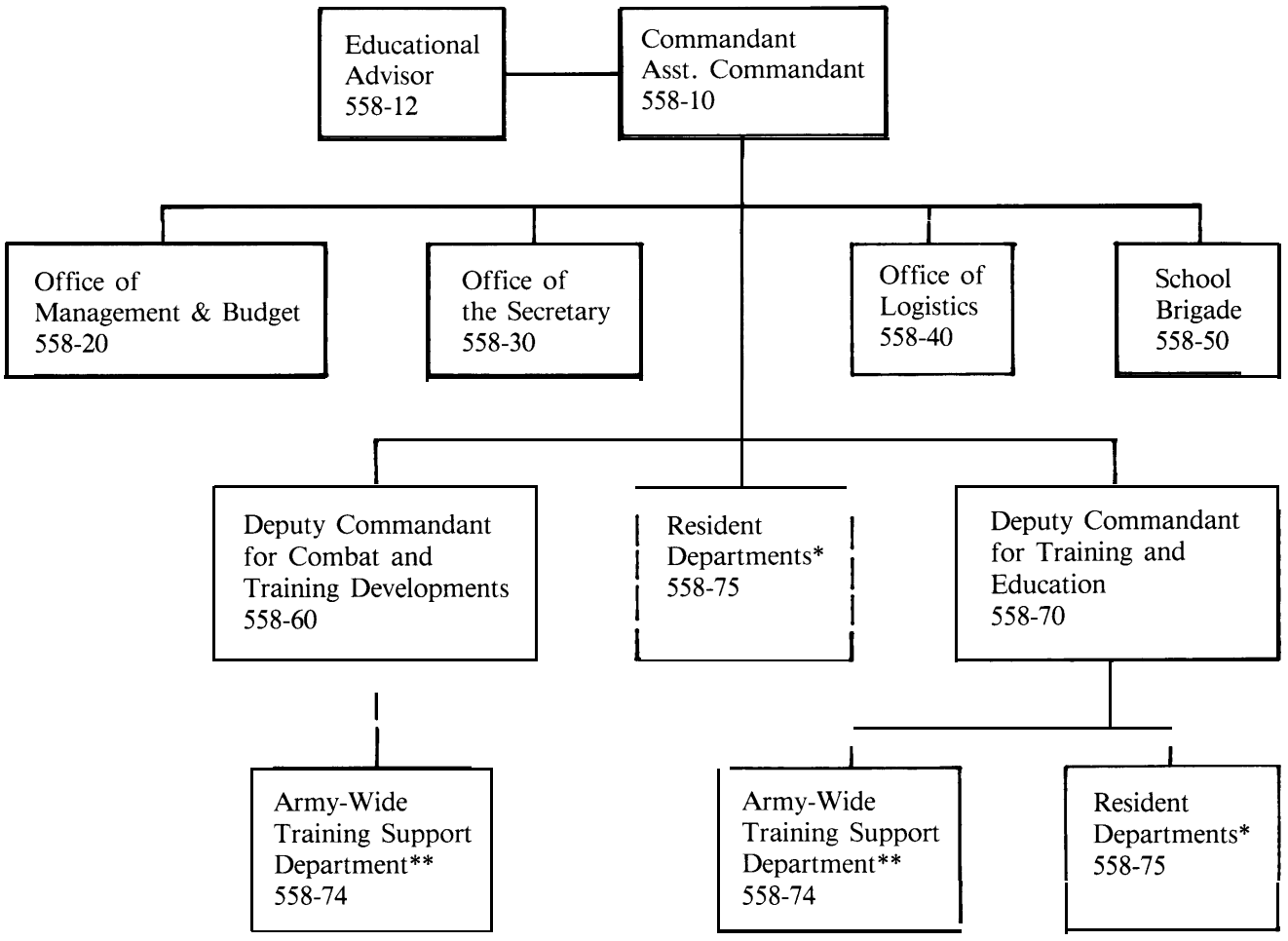
(2) Authorization Levels.
Detailed information and computation procedures concerning numbers and types of positions authorized for programed student loads are provided in DA PAM 570-558, Staffing Guide for U.S. Army Service Schools. Information pertaining to a specific school is

available from the most recent Manpower Survey Report, and Training Base Review (TBR) statistics.

F. Instructional Support.
While the common teaching method of lecture and testing is applied widely in many courses, the use of visible, audible, and manipulative ("hands-on") training aids has been a tradition in Army training. Consequently, use of training devices in Army schools has reached a high level in scope and sophistication. Training devices include actual army equipment, full scale mock-ups, simulation models, programed display panels, motion pictures, cable and cassette TV systems, recordings, programed self-instruction casette and computer terminals, graphics, felt boards, multi-frequency lighting, etc. Depending on the size, nature, and complexity of these devices, classrooms might become more or less "dedicated" in order to accommodate their usage. It is expected that the trend toward sophisticated training devices will result in a continuing requirement for large amounts of dedicated special purpose classroom space; however, the necessity for dedicated classrooms can be minimized by providing as high a degree of flexibility in general classroom design and equipment as possible.

G. Unique Characteristics.

(1) Frequent Changes in Instructional Program and Student Load.
Since much service school instruction involves training in the use and maintenance of Army equipment, changes in this equipment or in the procedures governing its use require corresponding changes in instructional programs. Changes in student load due to changing Army manpower requirements are also common. The number of students in training may vary widely between successive classes, and this situation often occurs with little advance notice.



*Resident Departments may optionally be organized under the Office of the Commandant

**Army-Wide Training Support Department may optionally be placed under the Deputy Commandant for Combat and Training Developments

Figure 2-1
U.S. Army Service School Organization Chart

(2) Required Readiness for Mobilization.
Emergency mobilization will produce a sudden and substantial increase in the student and instructor population, resulting in a population level that may be three times as high as that of normal conditions and require multiple-shift school operations.

(3) Emphasis on "Hands-On" Training.
A large percentage of service school instruction consists of hands-on training; that is, practice in operating and maintaining actual or simulated Army equipment. This type of instruction often requires a large number of specialized training laboratories and shops with convenient access for large pieces of equipment.

(4) Low Instructor-Student Ratio.
Service school instructional methods are generally based upon low instructor-student ratios, sometimes as low as 1:2. Therefore a larger amount of space must be programed for instructor support than is the case in most civilian educational facilities. This does not mean, however, that each instructor requires an individual space; a large percentage of Army instructors is involved in group activities, such as maintaining school equipment and property, when they are not teaching. Such personnel do not require individual offices or activity spaces.

(5) Accommodations for the Handicapped.
Provision must be made for those visitors, members of the staff, and civilian students who may be handicapped. Design shall be in accordance with AEI - Design Criteria, Chapter 7.

H. General Planning Factors.
Each U.S. Army Service School has a unique instructional mission. The success of school design is measured by the efficiency and effectiveness with which each school can accomplish its mission in the spaces provided. A successful school design, therefore, must respond to the particular requirements of the individual service school. The following general information about service schools should be considered in preliminary school planning.

(1) More than 75% of all service schools fall into three categories based on the ratio of shop to classroom instructional space:

a. Schools having predominately shop instructional space (4:1 ratio, shop to classroom space).

b. Schools having approximately equal amounts of shop and classroom space.

c. Schools having predominately classroom instructional space (4:1 ratio, classroom to shop space).

(2) These three categories represent a grouping of service schools according to average square footage per person:

Category	Average Square Footage per Person
a	300
b	215
c	175

(These figures are based on gross area tabulations and school population figures for FY 72 as furnished by HQ, TRADOC. The population figures include both students and authorized military and civilian school personnel.) Although these figures are averages and thus cannot be used as firm planning criteria, they nevertheless suggest that a relationship exists between a school's shop-classroom ratio and the gross area per person that the facility must provide. They also furnish a rough quantitative measure of the space required by the different kinds of service schools. These data, when combined with specific local information, may be useful for preliminary planning studies.

2-3 Planning the Service School

A. Requisites.
The sequential activities whereby a project is authorized and constructed are delineated in AR 415-15, AR 415-17 and AR 415-20. Since most U.S. Army service schools represent a large investment in physical plant by the Army, a thorough study should be initially performed by the using service including feasibility, program evaluation, economic analysis and construction requirements. Such studies should consider full or partial utilization of existing available space, new facilities, alternate site locations, rental space, contracted training, joint use of training facilities under other commands and services, etc. AR 37-13, Economic Analysis and Program Evaluation, contains instructions for performing an economic analysis and program evaluation. As a minimum, such studies must establish the site of the school, the program of construction (both renovation and new), and the approximate cost. Such initial studies shall not include design beyond the level of establishing building area and site support requirements. Due to the complexity of the problem of relating a changing curriculum and student load forecast to the changing technologies in teaching aids and construction, the services of a consultant may be desirable. Once the requirements are established, the using service must prepare a DD Form 1391, Project Development Brochure and other documentation to obtain HQDA, DoD and Congressional approval and funding.

B. Planning the Site.

(1) HQDA Approved Siting.
The site of the facility shall be as shown on the HQDA approved Installation Master Plan of the installation. If the facility is not shown thereon, approval must be obtained in accordance with AR 210-20, Master Planning for Permanent Army Installations, before the project will be reconsidered for design and construction. The location selected should be responsive to the economic analysis discussed in 2-3a above and 2-4 below, and should meet the following functional requirements, as applicable:

a. Sufficient real estate to permit accommodation of buildings, outdoor training areas, parking, student housing and mess facilities, and other support required at the site.

b. Near to existing available quarters and installation support facilities such as post exchanges, libraries, training aids facilities, etc.

c. Relatively quiet and uncontested area conducive to study.

(2) Site Sketch.
Although a detail site plan is not normally required for submission with the 1391, preparation of a site sketch will assist in preliminary budgeting. A tentative orientation should be established taking into consideration the following factors:

a. Convenience of access for pedestrians, drivers and service vehicles.

b. Direction of sun and prevailing wind.

c. Land forms, grading and drainage.

d. Views.

e. Location of utility connections of adequate size.

f. Future expansion.

g. Access to field training areas.

(3) Estimating Site Costs.
Empirical Cost Estimates are prepared in accordance with AR 415-17, which provides unit cost figures for all types of building and support facilities normally required for service schools; therefore, establishing the costs of site requirements is initially the most important consideration. Specific site utility requirements must be estimated by mechanical and electrical design engineers. Separate items should be listed under Supporting Facilities (Blank 21) on DD Form 1391 (Figure 2-2) to include, as appropriate:

a. Site preparation

b. Grading*

c. Paving (drives, parking and walks)*

d. Demolition

e. Water

f. Sanitary sewer

g. Gas

h. Fencing

i. Landscape planting

j. Exterior electrical*

k. Communications

1. Signage*
*Including features for the physically handicapped.

C. Planning the Buildings.

(1) Space Requirements.
With the exception of General Academic Classrooms, AEI - Design Criteria does not set forth space allowance criteria for service school facilities. The space program requirements should be prepared by using the service in conjunction with initial feasibility studies. This information should be updated if the forecasted curriculum and/or student load change during the process of authorization. Actual space requirements should be estimated using the information in this guide and the appropriate figure entered in Blocks 18.f, 20.a, 23a, and 23.h of DD Form 1391. The size of mechanical space required to heat and air-condition the school should be estimated by a mechanical engineer and entered separately on Block 20.b. as “Heating and Air-Conditioning Plant” or ‘‘Mech Room”, as appropriate. The figure obtained from the addition of all building area requirements should be entered on the top line of Block 20 of DD Form 1391. Block 17.a. should be checked and ‘‘DG 1110-3-106” should be written in block 17.c. See AR 415-15 for complete instructions on completing DD Form 1391.

1. COMPONENT	FY 19____ MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		

3. INSTALLATION AND LOCATION	4. PROJECT TITLE

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)

10. DESCRIPTION OF PROPOSED CONSTRUCTION

DD FORM 1 DEC 76 1391 — PREVIOUS EDITIONS MAY BE USED INTERNALLY UNTIL EXHAUSTED. — PAGE NO.

FOR OFFICIAL USE ONLY

(WHEN DATA IS ENTERED)

Figure 2-2
DD Form 1391

(2) Estimating Building Costs.
The unit cost figures shown in AR 415-17 include equipment and furniture which is permanently built into or attached to the structure. These include the following items which should be estimated as part of the bulding cost.

a. Built-in counters, sinks and shelving.

b. Efficiency kitchen unit and drinking water coolers.

c. Central PA and speaker system.

d. Telephone, fire alarm and intercom systems.

e. Built-in laboratory furniture, hoods and vents.

f. Built-in typing and tape playing decks.

g. Built-in movable partitions.

h. Built-in projection screens.

i. Elevators and conveyors.

j. Waste disposers.

k. Floor and window coverings.

j. Chalk boards, bulletin boards and display cases.

m. Signage and graphics.

n. Special features for the handicapped.

o. Other specialty items as identified.

D. Planning for Interior Furnishings.

(1) Preliminary Schedules.
Interior furnishings must be planned in coordination with the buildings in order to develop a totally integrated and useful facility. Items which are portable or detached from the structure must be identified for procurement by the installation using service utilizing other than MCA funds. Sources for selection of furnishings and equipment are provided in the GSA Federal Supply Schedules, the Federal Prison Industries Schedule of Products and the general GSA Supply Catalog.

(2) Estimating for Interior Furnishings.
Much of the Service School equipment and furnishings are portable and therefore, not included in the building cost estimate. These items must be estimated separately and programed for procurement utilizing Operations and Maintenance, Army (O&MA) or other funds. Estimates for furnishings should be based on the mandatory source prices, plus escalation. Paragraph 6 of the required supporting data for DD Form 1391 must include a summary and cost of the furniture and equipment that is being programed from funds other than MCA. The following list indicates some of the items that should be included in paragraph 6, supporting data for DD Form 1391.

a. Audio-visual equipment, TV systems.

b. Training equipment including simulators.

c. Chairs, tables, study carrels.

d. Lounge furniture.

e. Service carts and equipment.

f. Storage and filing cabinets.

g. Microfilm equipment.

h. Reproduction machines.

i. Wall clocks, plug in.

j. Other items identified as detached.

(3) Scheduling Procurement.
Estimates of items being programed from funds other than MCA must be finalized using the most current mandatory source prices. Procurement should be scheduled so that the furnishings are available shortly **before** the projected date of beneficial occupancy.

2-4 Designing the Service School

A. Requisites.
Activities associated with the development and execution of design are outlined in AR 415-20 and ER 1110-345-100. The AEI - Design Criteria, is the basic criteria reference. Technical Manuals (TM) and other documents state additional criteria. Design must be based on the requirements and estimates established in the final approved DD Form 1391. Present procedures require preparation of design analysis, drawings and specifications. Preparation of these documents is covered in ER 1110-345-700, 710, 720, respectively. In preparing these documents, the following guidelines should be applied.

B. Designing the Site.

(1) References.
Site design must be accomplished in accordance with applicable portions of the AEI - Design Criteria, TM 5-822-2 and 3, TM 5-830-1 and the completed Project

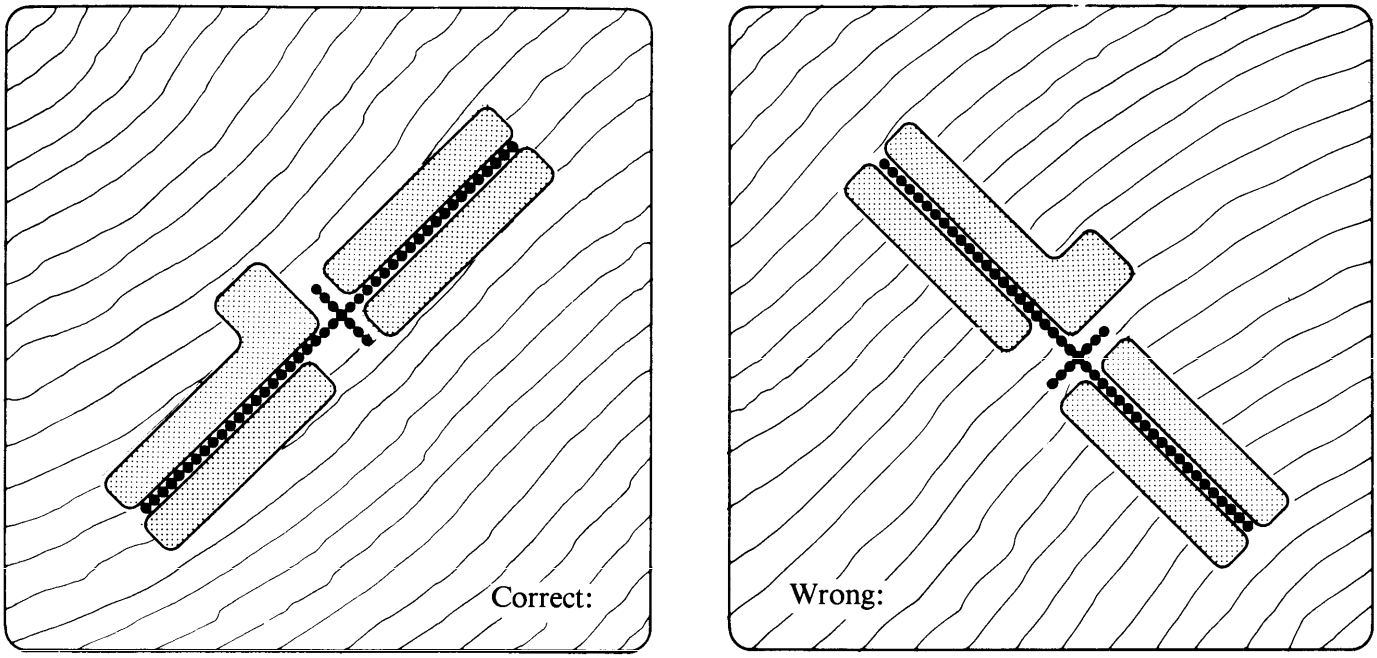


Figure 2-3
School Siting, Sloped Terrain

Development Brochure for the individual project. The objective of site planning is to develop the relationships between the school and such elements as the terrain, climate, and post so as to maximize the efficiency and economy of school operations while rninimizing disruption of post activities and the natural environment.

(2) Building-Site Relationships.

(3) Environmental Planning.
Site design must take into account the terrain, surface and subsurface characteristics of the soil, local vegetation, and climatic conditions, and must include a thorough assessment of the impact of the facility on the environment in accordance with the requirements for environmental impact statements.

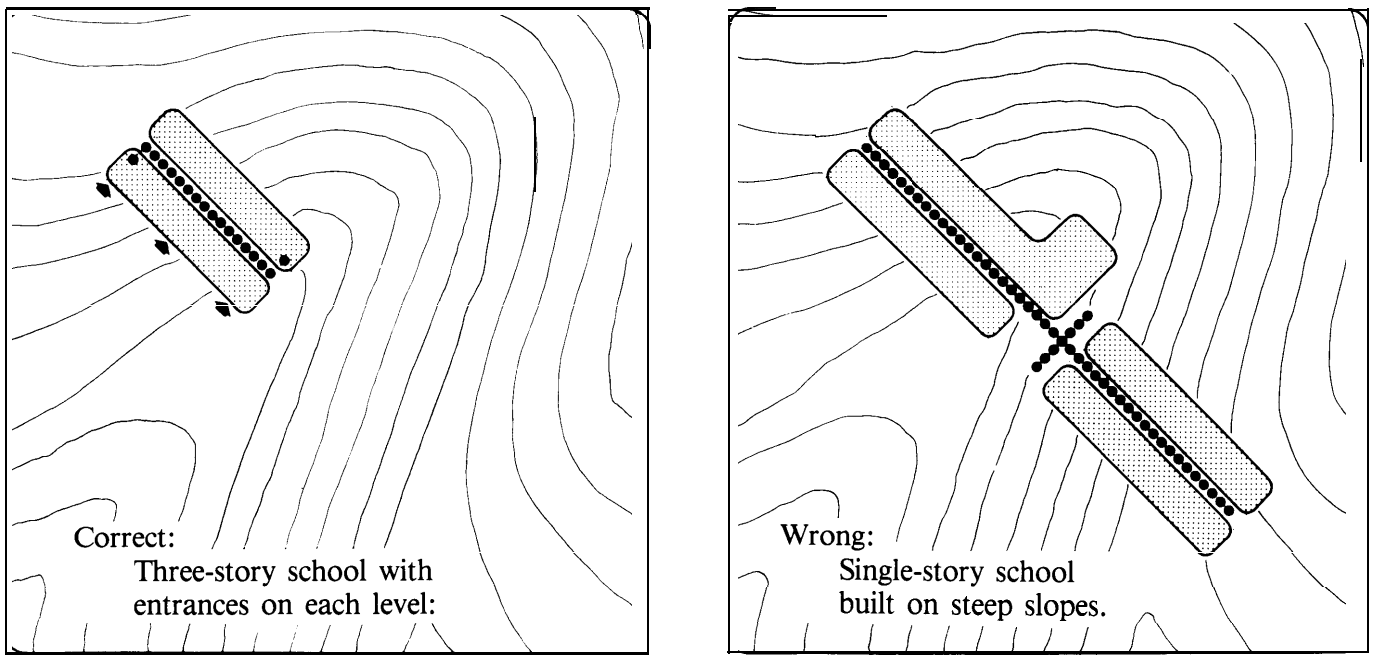


Figure 2-4
Building Type/Slope Relationship

b. Terrain Configuration.
The site planning process requires analysis of the scale and character of the geographic and topographic features of the site. Large scale features, such as site slope characteristics, require specific architectural and planning responses, while smaller scale features should be considered from the standpoint of their potential value in enriching the school environment. Wherever possible the design shall minimize environmental impact while maximizing ease of construction. For example, the facility should be designed so as to cross as few elevation contours as practical (Figure 2-3). If other considerations, such as solar orientation, dictate that the facility must cross major variations in slope contour, the building should utilize a vertical, rather than horizontal, spatial organization (Figure 2-4). Such designs minimize the amount of earth-moving necessary for site preparation, thereby reducing environmental disruption and enhancing ease of construction.

c. Surfaces and Subsurface Soil Characteristics.
The organic composition and drainage characteristics of the soil determine the landscaping potential of the site and must be considered during the site selection process. The drainage characteristics and compressive bearing strength of the soil are critical in foundation design and must be determined in accordance with TM 5-818-1, **Procedures for Foundation Design of Buildings and Other Structures.** The determination of soil drainage characteristics will also include assessing the effects of the facility and its adjacent paved areas on the ground water level.

d. Climatic Conditions.
Skillful utilization of natural environmental controls can significantly increase building economic efficiency. Factors to be considered include prevailing winds, topography, and vegetation. Facilities located in areas subject to extreme climatic conditions shall be designed so as to minimize heating and cooling requirements. In general, this is accomplished by designing multi-level, compact buildings which minimize heat transfer gains and losses (Figure 2-5). The siting and orientation of facilities must take into account the velocity and direction of prevailing winds. These data will be used in planning for the dispersal of emissions (smoke, fumes, dust) and in designing building shapes and configurations so that winds and drifting snow do not disrupt vehicular and pedestrian circulation. The exploitation of natural controls may require a less compact building shape, or an orientation other than north-south. When programing for a particular project, the advantages of compactness and north-south orientation must be weighed against the increased efficiency to be derived from a full exploitation of natural controls.

e. Vegetation.
Landscape planting is one of the most effective methods of adapting a school to its site. As far as possible, indigenous vegetation will be preserved throughout the facility complex. This natural growth should be supplemented with planting that employs locally occurring plant species. This technique of preserving indigenous vegetation and planting with local species is one of the simplest means of developing the regional character of the site.

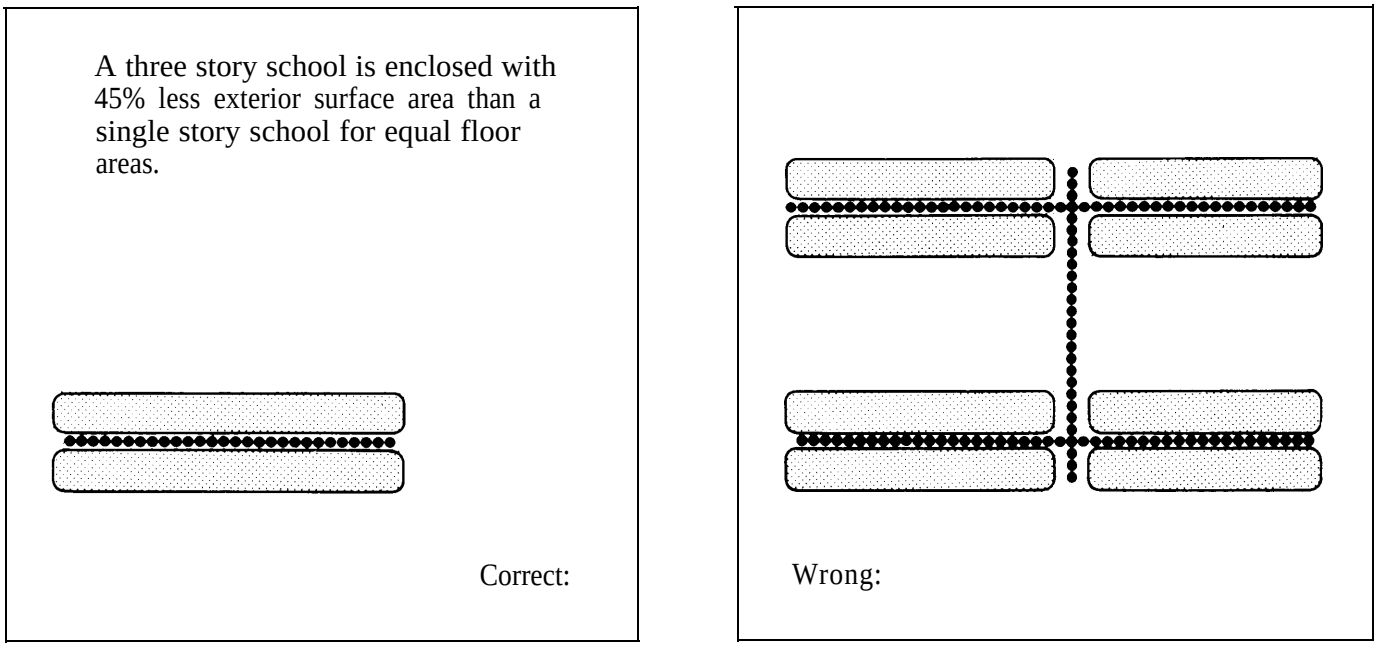
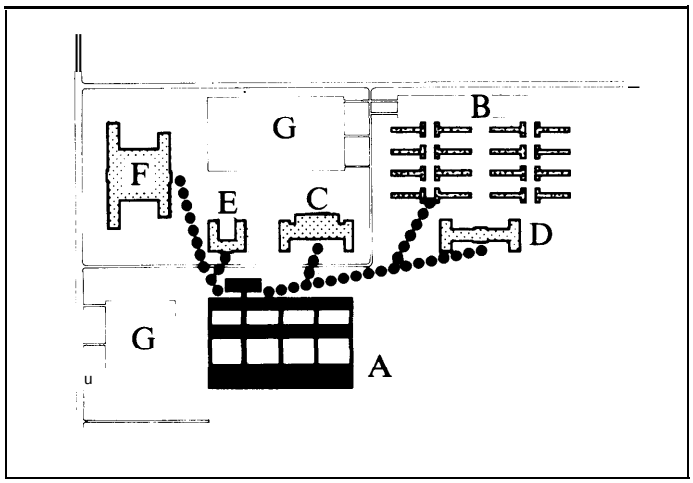


Figure 2-5
Building Type/Climate Impact



A Service School
B Bachelor Housing
C Post Exchange
D Dining Hall
E Training Aids Facility
F BOQ
G Parking

Figure 2-6
School-Post Relationships

f. Screening of Utility Features.
Utility areas, such as trash bins, transformers, utility connections, etc., should be screened to the maximum extent practicable by sue of plantings, land forms, and architectural screens to blend with the surroundings. Utilities located on roofs should be carefully studied during architectural detailing.

g. Views.
A landscape is usually perceived from a number of viewpoints: sidewalks or paths, terraces, entrances, windows and balconies. Lines of sight should be carefully analyzed. Pleasant aspects of existing views should be maximized, with care taken to avoid views into the sun. Windows should be located so as to provide both natural lighting and contact with the natural environment.

h. Relationship of School to Post.
The school-post relationship involves interactions of both function and circulation. The service school should be designed so as to establish a close relationship to supporting post activities. (Figure 2-6). The most important of these are:

- Bachelor Housing. The school should be designed to promote pedestrian circulation between the school and associated bachelor housing.
- Dining. The prime consideration here, as with housing, is facilitating pedestrian circulation. Appropriate dining facilities for all types of personnel (military and civilian) shall be provided within walking distance of the school. If existing facilities are inadequate or unavailable, snack bar and cafeteria space shall be programed with the school.
- General Post Services. When feasible, the school site should be arranged so that school personnel can walk to such major post services as the PX, commissary, laundry and dry-cleaning facility, and recreation centers.

i. Future Expansion.
The school will be designed so as to allow for future expansion taking into consideration existing or planned post facilities which would limit orderly growth of the school. (Figure 2-7).

(3) Vehicular - Pedestrian Systems.

a. Organization.
The school site must be planned so as to minimize conflict between school and post circulation patterns. To achieve maximum pedestrian flow and safety, vehicular arterials should not run through the school grounds or between the school and such school-support activities as housing and dining facilities, formation areas, and field training areas. (Figure 2-8).

b. Service Areas.
Access for fire fighting equipment and trash removal equipment must be provided. Unloading facilities for deliveries must be orderly in appearance and not in conflict with pedestrian or vehicular traffic. Service areas and service roads must be sized to accommodate the turning radii and maneuvering requirements of the largest vehicles. At the same time, the extent of paving should be minimized. Screening of service areas should be accomplished in conjunction with the screening of utilities features.

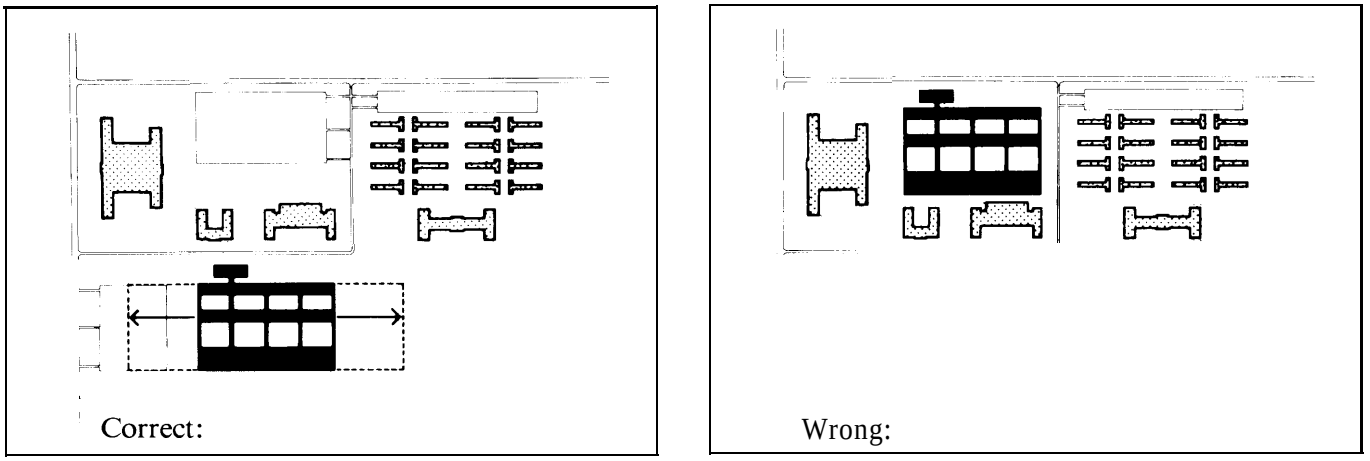


Figure 2-7
Siting for Expansion

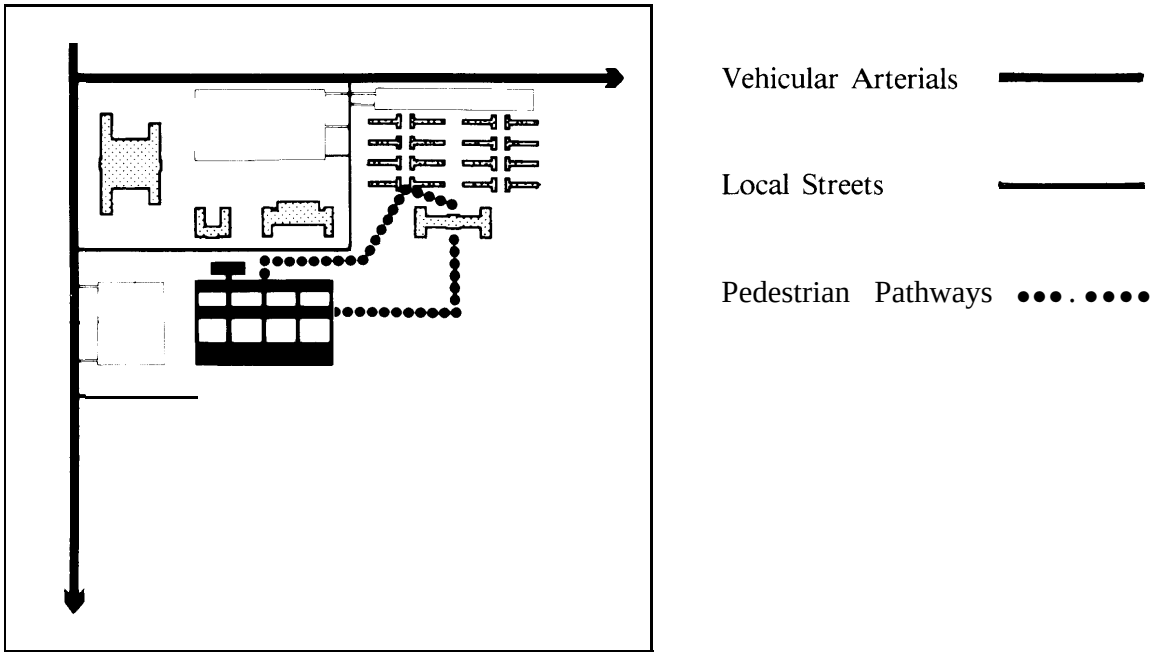


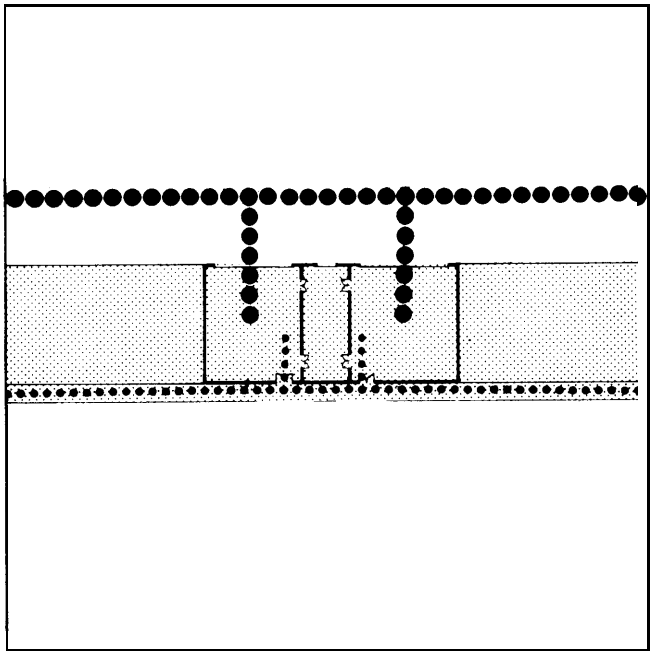
Figure 2-8
School and Post Circulation Systems

c. Shop Areas.
Access to shops must be provided for students and instructors, for training equipment, and for supply deliveries. Pedestrian access should be from one side of the shop, vehicular access from another. (Figure 2-9). Training equipment and delivery vehicles may share common circulation routes. Shop access is also affected by the size of the equipment to be housed. Shops planned for unusually large equipment, such as cargo helicopters, may require a single large entranceway at one end of the shop. (Figure 2-9). Shops designed to house a number of smaller items, such as trucks or tanks, may require entrances on two or more slides to facilitate movement of equipment. (Figure 2-10).

d. Walkways.
Selected major walkways must be designed to support vehicular traffic such as fire-fighting equipment, delivery vehicles, and vehicles moving heavy or bulky items. Such walkways should be a minimum of 12 feet wide. Walkways for the physically handicapped should be a minimum of 6 feet wide.

e. Formation Areas.
Site design will include identifying large, open spaces to be used as student formation areas. Ideally, these areas should be located on the side of the school closest to student housing and dining facilities.

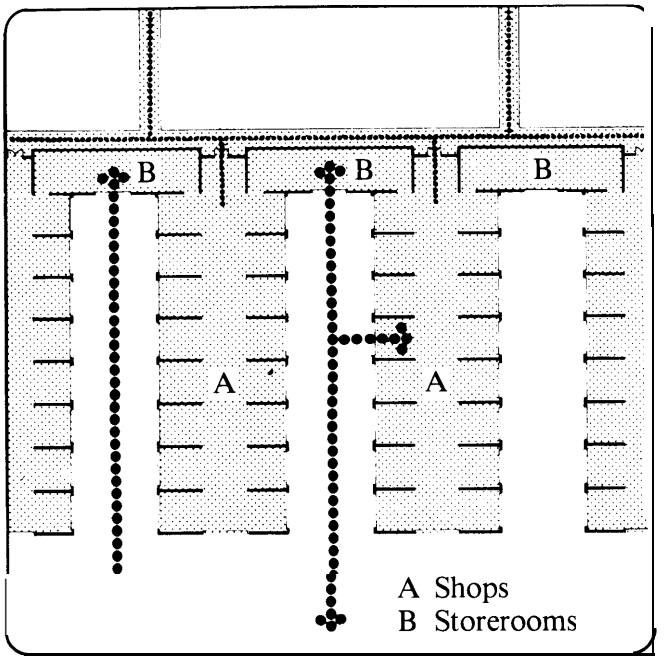
f. Parking Areas.
Parking areas must be provided for the school staff and visitor who drive to school daily. These areas should be placed along the edges of the facility so as not to interfere with pedestrian circulation within the



Pedestrian Circulation ••••••••••••••••

Vehicular Circulation ●●●●●●●●●

Figure 2-9
Shop Area Circulation



Pedestrian Access ••••••••••••••••••••••••••••

Equipment and Delivery Access ●●●●●●●●●

Figure 2-10
Multi-Bay Shop Area Circulation

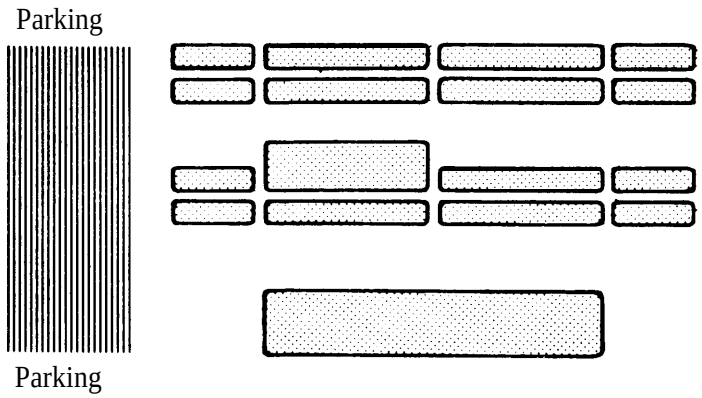


Figure 2-11
Siting Parking Areas

school. Parking facilities for the handicapped shall be in accordance with AEI - Design Criteria, Chapter 7. Parking areas shall be adequately landscaped to soften the impact of large paved areas. Planting shall be supplemented when topography permits by depression or earth mounding. (Figure 2-11).

g. Field Training Areas.
Most U.S. Army service schools conduct a portion of their training in the field. Circulation must be designed to allow direct access to field training areas; students and equipment enroute to field training areas should not disrupt school or post circulation patters. (Figure 2-12). Where field training areas must be located at a remote location, provision shall be made for covered marshaling terminals at the service school site to accomplish orderly transportation of classes to the field.

h. Lighting and Signage.
Lighting shall be provided along all streets, pedestrian ways, and parking areas to accommodate safe and efficient vehicular and pedestrian circulation. Lighting shall also be provided for night-use outdoor training areas and other outdoor peripheral facilities necessary to the mission of the school. Directional and identification signs must be furnished to locate all buildings, access drives, parking and entrances. Features for the physically handicapped, restricted areas, service access, and other special use areas will be identified. Signage and graphics must be in accordance with TM 5-807-10.

(4) Drawings.
Site plans should show, as a minimum, floor elevations, existing and finished grades, existing and proposed buildings, roads, parking and utilities in the immediate project vicinity, outside utility connections, existing vegetation, proposed lawns and planting masses, and solar orientation. Grading, paving, utility and landscape planting plans must also be prepared.

C. Designing the Buildings.

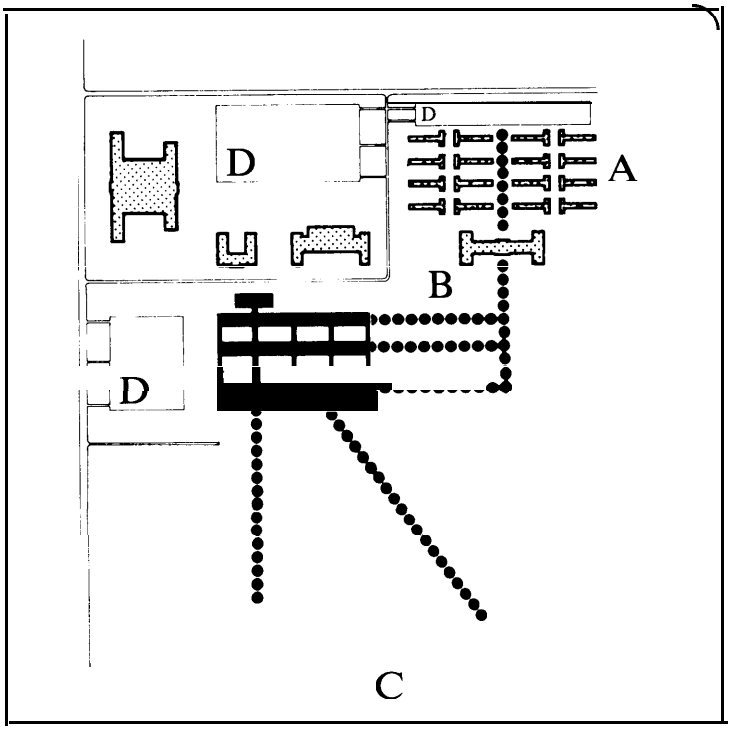
(1) References.
Building design must be accomplished in accordance with applicable portions of AEI - Design Criteria, the

completed Project Development Brochure for the individual project, and applicable Army technical Manuals and Engineers publications identified separately under the following headings.

(2) Architectural.

a. Character.
The architectural character of a facility directly affects its users and their activities. A good design incorporates organizational and sensory characteristics than enhance the functional activities of the facility.

- Inviting Design Characteristics. A primary goal of the design process is to create a school that is inviting and convenient to both occupants and visitors. Especially important are the location, expression, and identification of entrances. Another aspect of this effort includes the selection of colors and textures that relate appropriately to the environmental context of the school and post. School buildings should exemplify the characteristics of local and innovative construction practices, with materials chosen on the basis of availability, simplicity and economy, and capability to generate visual interest.
- Adaptation of Environmental Context. A primary measurement of good architectural design is the success with which it is adapted to a particular environment. Specifically, such factors as site and climate provide the basis for determining appropriate architectural responses. For example, a desert environment requires a facility that provides protection from heat and glare, with entrances that accomplish a comfortable transition between the bright sun on the exterior and the relatively dark interior. In wet climates, rain protection along passages between buildings shall be considered, and in extremely hot or cold climates, compact single-structure schools that minimize outdoor circulation are appropriate. Environmental considerations such as these are an integral part of an attractive and functional design.
- Facility Identity and Organization. The typical service school conducts many short training programs and has a large and rapid turnover of students. If these students are to become familiar with the school in the short amount of time available to them, the school must be readily identifiable as a unit and have a visually apparent organization that facilitates orientation and circulation. It is important that the room and corridor identification system be clear, especially in larger facilities. Furthermore, all such systems must be capable of extension in the event school facilities are expanded.
- Sensitive to Architectural Context. All new construction should be sensitive to adjacent construction with historic significance. Such building design should follow guidelines in TM 5-801-1.



A Bachelor Housing
B Dining Hall
C Field Training Areas
D Parking

Figure 2-12
Planning Related Activities

- Lockers. Lockers should be near classroom and training spaces. Crowding can be avoided by making corridors wide enough to accommodate both the normal traffic load and the activity of students at lockers lining the corridor walls. Congestion can also be relieved by placing locker sections and groupings off main corridors.
- Intersections and Circulation Nodes. As illustrated in Figure 2-14, corridors should widen at points of queing and decision such as corridor intersections and entrances to stairways. Space must be provided at these points for pedestrians to pause or circulation flow will be impeded. At building entrances, the corridor must widen to provide space for entering personnel to orient themselves and exiting personnel to prepare for outdoor weather conditions; moreover, adequate lighting must be installed at entrances to aid those entering in adjusting to a lower level of illumination. (See paragraph 3-3b(3).
- Corridors should be safe. Their walls should be free of all projections. Heating units, drinking fountains, fire extinguishers, lockers, doors, and display cases should be recessed for safety and designed for use by the physically handicapped in accordance with paragraph 2-4c(2)(f) below. Corridors should be lighted to 20 foot-candles; emergency lights should be installed to provide lighting in case the main power fails. Floor coverings should be durable, skidresistant, and easy to maintain. The maximum length of unbroken corridors should not exceed 150 to 200 feet; longer sections give an undesirable perspective.
- Restroom, Drinking Fountains, Mechanical/Electrical Closets, and Janitors' Closets should be located at corridor intersections. Because of the additional corridor space available at these points, access to such facilities will not disrupt main circulation patterns. Furthermore, since corridor intersections are also nodes for utility distribution systems (see paragraph 5-4a(2)), the necessary plumbing and electrical wiring for these facilities are readily available.
- Room Exits. All doors should be at least 3 feet wide. They should open in the direction of an exit, and be recessed so as not to protrude into the corridor when they are opened. The path of travel should be clear and level for 6 feet on the pull side of a doorway; the floor should be clear and level for at least 4 feet on the opposite side. On the pull side of the door, the floor should extend at least 18 inches beyond the doorway strike jamb. The door to toilets may be deleted, if the design permits. (Figure 2-13).
- Stairs shall be designed on the basis of a flow rate of 12 persons per foot of stair width per minute. This will produce stairs which maintain a comfortable flow rate. For example, in Figure 2-14 the stairs are designed for a circulation load of 250 people. The two 5 foot wide stairs will provide for 120 persons per minute; thus the entire occupancy could be transported between stories in slightly over 2 minutes. In a three-story building of the same floor plan, a little more than 4 minutes would be required. This is sufficiently rapid for normal service school requirements.
- Elevators. Multi-level school buildings may be equipped with combination freight and passenger

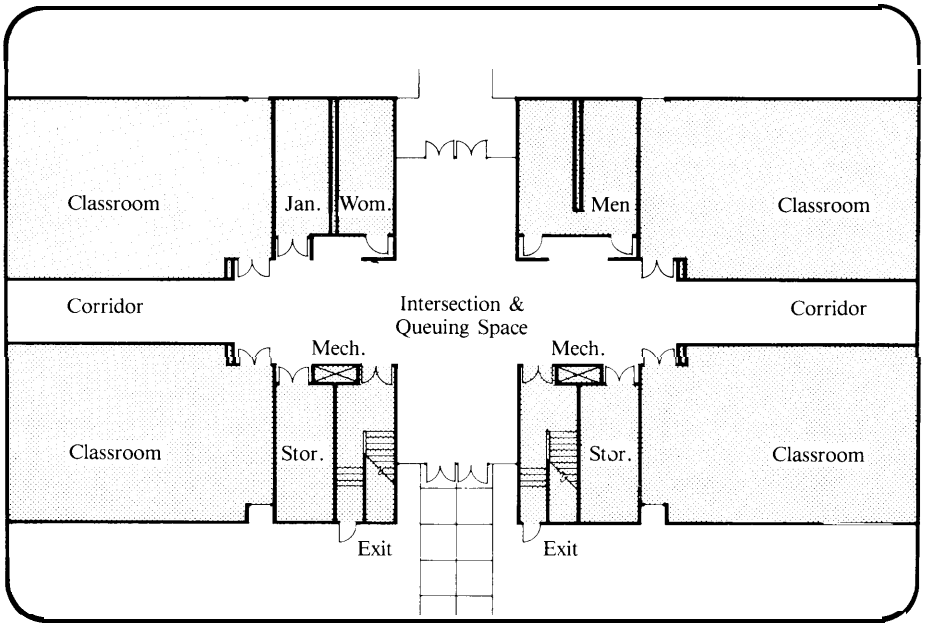
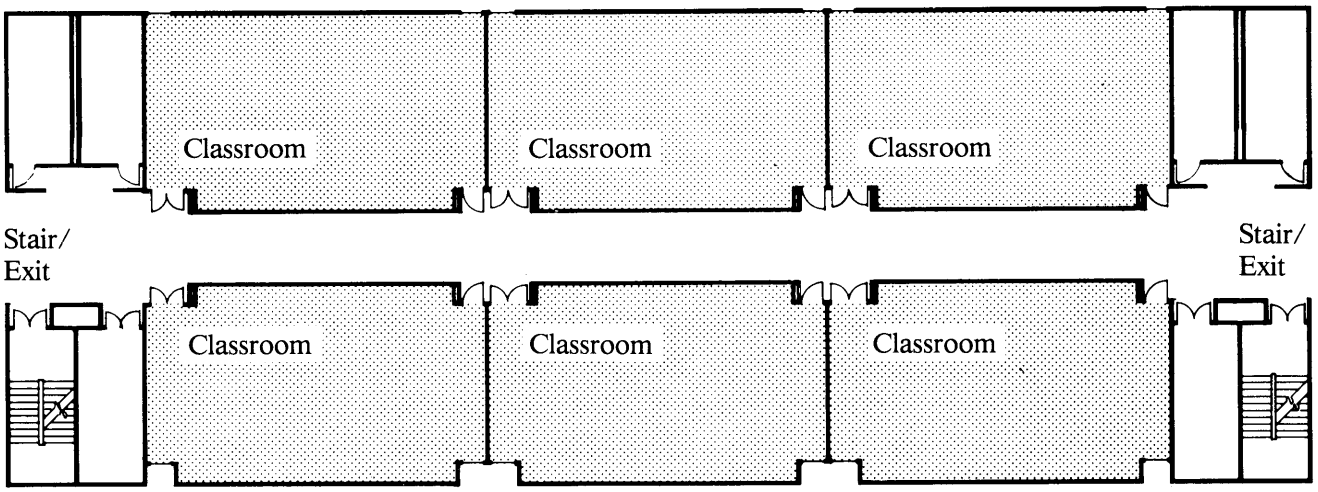


Figure 2-13
Corridor Intersection



1500 Sq. Ft. Classroom
6 X (1500 Sq. Ft.) — 9000 Sq. Ft.

Figure 2-14
Group of Classrooms.

elevators when necessary to move heavy or bulky materials between floors. Use of passenger elevators will be kept to the minimum necessary to meet operational requirements.

f. Use by Physical Handicapped.
The building must be accessible to and usable by the physically handicapped in accordance with AEI - Design Criteria, Chapter 7. Buildings should be organized in the early stages of design for access and use by handicapped civilian employees, visitors and students. For the most part handicapped persons should be able to act independently in order to pursue opportunities which would normally be afforded able-bodied persons.

g. Energy Conservation.
The basic elements of conservation design include:

- Building Shape. Heat gains and losses in a building are directly proportional to the area of its exterior. Therefore in climates which require a great deal of heating or cooling energy, multi-story buildings, which increase floor space per unit area of exterior surface, should be provided unless incompatible with functional requirements.
- Wall Shading. A substantial proportion of the air conditioning requirement for most buildings results from solar energy absorbed by building surfaces. By simply shading those postions of the building receiving the most sun, cooling requirements can be significantly reduced. Methods of wall shading which should be considered include applying various forms of canopies or louvers to the walls, and deciduous trees. Each wall of the building may require a different treatment depending upon its orientation to the sun.
- Control of glass areas. In cases where the shading methods mentioned above are not practical, the choice of window glass becomes important. At a radiation angle of incidence of 40 degrees, ordinary glass admits 85% of the solar thermal energy that strikes the glass surface, while reflective glass admits 63%, heat-absorbing glass 60%, and certain specialized glasses as little as 28%. Windows may also be recessed as illustrated in Figure 2-16. Such a design shades the window glass, substantially reducing the amount of solar energy striking the glass surface. These alternatives shall be considered in the life cycle cost analysis.

h. Color.
Use of color in Army facilities is limited to a practical number. Appendix A discusses color and notes where to get example color schemes.

i. Finish Materials.
Interior finishes must be appropriate for the designed function of the building and spaces. Selection of materials should be based on low maintenance qualities considering the anticipated use, life cycle cost impact, fire and other safety requirements. Decisions concerning the extent of carpet installation must be coordinated with the using service and should be based on distinct functional advantages, such as acoustics, safety and maintenance. The color, texture and pattern of materials should complement the overall building design. Native (local) materials should be used to the greatest extent practicable. Long-life materials such as stones, tiles, woods, plastics, and vinyls should be selected to provide attractive colors, textures and

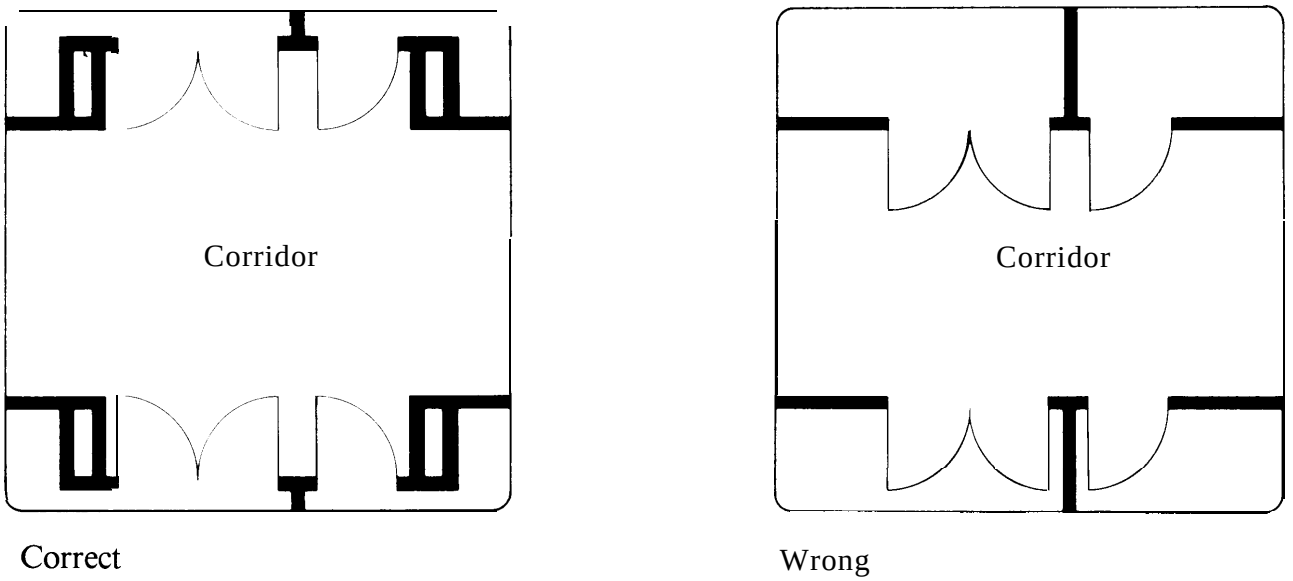


Figure 2-15
Recessed Room Exit.

patterns that will not quickly become out-dated. Interior finishes must conform to the flame spread and smoke development standards contained in AEI - Design Criteria and NFPA 101. Painted surfaces and patterns are relatively easy and inexpensive to refurbish and can be kept fresh and up-to-date in appearance. The following items should be considered for reducing maintenance on all buildings: sealed concrete floors, removable carpeted elevator floors, entrance mats, cove bases at all floor/wall connections, hard-finish (glazed concrete block, ceramic tile, etc.) walls, wall corner guards, push plates, and large metal kickplates on doors. Guidance for interior design may be obtained from DG 1110-3-122.

j. Wall Graphics.
While mainly decorative, such graphics may frequently incorporate floor numbers, directional indicators, safety markings, Army insignia, and so-on. When professionally done, they can be most effective in livening up dead spaces and producing interest such as in large rooms or circulation spaces.

k. Signage.
Signage must be specified as an overall system, coordinated with exterior and interior signage prescribed in TM 5-807-10. The system should assure maximum economy, ease of procurement and installation, and standardization of application throughout the building. It must inhibit vandalism but be flexible enough to allow addition or deletion of information. The use of pictographs instead of words is recommended.

i. Safety Markings.
The locations of exits, fire protection and other safety equipment should be strongly emphasized as appropriate. Safety markings (signs for danger, warning or caution) should be designed in accordance with AR 385-30, Safety Color Code Markings and Symbols. Use pictograph sign panels approximately 12 inches square for Danger, Warning or Caution signs (Electrical hazard, etc.).

m. Storage.
Care shall be exercised during the planning and designing of Service Schools to identify the number, size and type of storage areas required. Inadequate storage provisions may result in general purpose classrooms becoming "dedicated" because of a requirement to keep rooms locked to protect equipment.

Two factors which effect the design of storage are the physical characteristics and frequency of use of materials to be stored.

- Whenever possible training equipment should be portable or movable.
- When indicated by the mission, provision shall be made to allow for movement of large, mobile equipment such as tanks, helicopters and military vehicles between classrooms and outdoor storage areas.
- Large equipment that is infrequently used and is not readily moved should be blocked from view by movable partitioning when not in use.

- Large and medium size equipment that is in daily use should be stored in place in dedicated shops and classrooms.
- Medium-sized equipment that is not in daily use, such as engines and mechanical assemblies, should be placed on dollies and stored in lockable spaces within 75 feet of the classroom.
- Light, hand-carried equipment should be stored in lockable spaces within 75 feet of the classroom. If such equipment is in daily use, storage should be provided in lockers in the classroom or in a room directly adjacent to the classroom.
- Special considerations such as environmental control and security shall be incorporated when necessary.
- Utilization of multi-purpose space developed for classroom use and divided to make provision for storage shall be given preference to construction of single use storage space.
- Adequate, secure storage for instruction materials, training aids, and audio-visual equipment should be planned for and located where needed. A general rule is to provide 1 1/2 square feet per student (this assumes that storage will be four shelves high).
- Space should be available to store outer clothing (coat racks) and other personal equipment within or near each training, work, or study area.
- Adequate filing space for learning materials can be provided by a sufficient number of filing cabinets or built-in storage selected and arranged for easy access within the learning space.

n. Security.

Security requirements and restrictions may differ for each Army Service School according to individual course content, materials, and equipment. The military commander of the installation or facility is responsible for designating and establishing "restricted" areas. Advice is furnished to him/her by the provost Marshal or Physical Security Officer, in coordination with the Intelligence Officer and the Staff Judge Advocate. "Exclusive," "limited," and "controlled" areas should be designated according to AR 380-20, AR 310-25, AR 50-5, and AR 190-21.

o. Adequate Area.

To make an initial planning decision, the school planner must have some idea of how much area to provide for mechanical space. To determine the amount of mechanical space required, multiply the net floor area by 0.05. For example, a facility with a net floor area of 13,300 square feet would require 665 square feet for mechanical equipment: 13,300 x 0.05 = 665 square feet. This area should be listed separately on the DD Form 1391, below the scope.

(3) Structural.

a. Selection.

Loads and criteria must be in accordance with AEI - Design Criteria and TM 5-809-1 through 6, 8 through 11. The structural systems and materials selected must

A Outdoors
B Interiors
C Roofline

South Wall

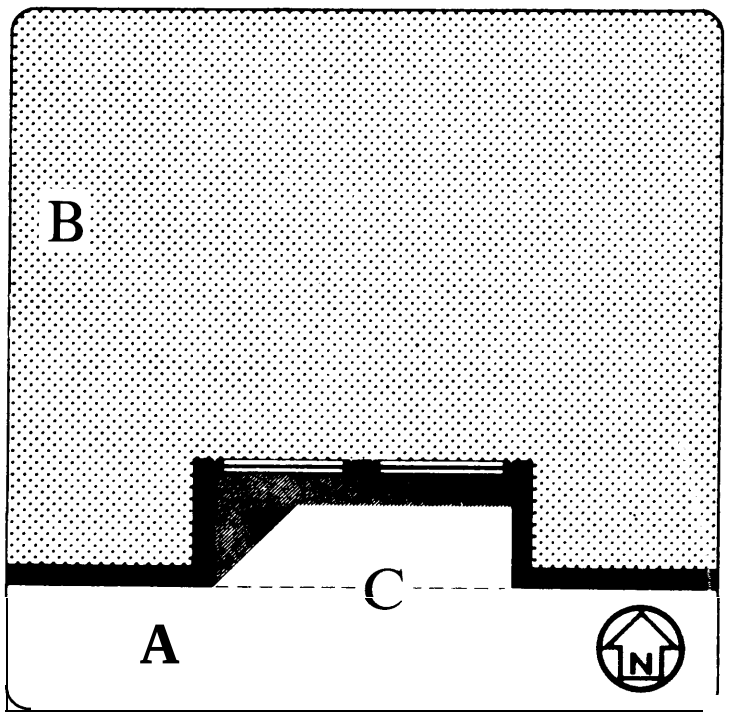


Figure 2-16
Glass Shading, South Elevation.

be suitable for permanent type construction, be capable of carrying the required loads, and be compatible with fire protection requirements and architectural and functional concepts. The structural system and features selected should be that system which is the most economical and suitable based on comparative cost studies for the building. Comparative cost studies should be made for the three most apparent competitive systems and take into account mechanical, electrical and other features where they vary between systems under study.

b. Versatility.
Due to changing instructional programs, the structure should be designed so that spaces within the buildings can be utilized for different purposes without sustaining the cost of major alterations. Bay or module spacing should be adequate to give the desired flexibility and convertibility in view of the interacting structural, mechanical and electrical elements involved. Structural design should include rigid framing connections to eliminate need for shear walls within blocks of activity space. Design loads for floors in non-dedicated classrooms should be uniform.

c. Protective Construction.
In locations where a deficit in PF 100 fallout shelter space exists under the Army Survival Measures Plan, described in AR 500-72, selected areas of the structure should be designed for dual use as fallout shelters. Technical and other requirements should be be accordance with TM 5-800-1, Construction Criteria for Army Facilities. Single-line plans showing locations, occupant loads, and minimum protection factors for the selected shelter areas must be included in project design analyses and completion records.

(4) Plumbing.

a. Selection.
Plumbing must be in accordance with TM 5-810-5 (and TM 5-810-6 if gas fittings are required). Water supply facilities must be as prescribed in TM 5-813-5 and 6. Sanitary sewers must be as prescribed in TM 5-814-1. Plumbing and fixtures shall comply with the "American National Plumbing Code A 40.8" or the "National Standard Plumbing Code", within the limits established by AEI - Design Criteria, Chapter 15.

b. Latrine Location.
Both female and male latrines shall be provided near administrative areas and on each floor of classroom wings, so as to allow for convenient use by staff and students.

c. Specifications.
Applicable CE Guide Specifications include the CE 300, 500 & 600 series.

(5) Mechanical.

a. Selection.
Heating, air-conditioning and ventilation must be in accordance with current AEI - Design Criteria and TM 5-810-1. The heat loss and heat gain calculations must be made in accordance with the current ASHRAE Handbook of Fundamentals. In the design of air-conditioning systems, various systems should be considered such as variable air volume, multizone, dual duct, single zone, a combination of systems and any other suitable systems covered by the current ASHRAE Handbooks. Within the design scope and environmental conditions required for various spaces, each air-conditioning system should be studied and the least energy intensive system selected based on life cycle cost and the energy analysis. Energy recovery systems should be investigated and incorporated into the design if economical. Reasons for selection and rejection of systems must be included in project design analyses.

b. Specifications.
Applicable CE guide specifications include the CE 301 series.

(6) Electrical.

a. Selection.
Electrical Design must conform to AEI - Design Criteria and TM 5-811-1 through 4. System characteristics should be selected to provide the most efficient and economical distribution of energy. Voltages selected should be of the highest order consistent with the load served. Three phase 208Y/120 volts should generally be used to serve incandescent and small fluorescent or mercury vapor lighting loads, small power loads, and receptacles. Consideration should be given to the use of three-phase 480Y/277 volt systems where such is feasible.

b. Lighting.
Intensities should conform to the minimum levels recommended by the latest edition of the Illuminating Engineering Society Lighting Handbook. OCE Standard Drawing No. 40-60-04, Lighting Fixtures, should be used to the maximum extent practicable. Sufficient local switching capability should be developed in the lighting design to achieve maximum and minimum lighting levels for facility operation. Such a provision should enable occupants to use maximum lighting only in that portion of the facility where it is needed, and to use a lower level of

illumination elsewhere. Where practical, lighting should be designed for specific local tasks instead of providing uniform general levels. For example, lighting for individual study carrels should be designed for a local illuminating of 70 foot-candles (the Illuminating Engineering Society standard for classroom lighting), while lighting for general room illumination need be designed for only 30 foot-candles (minimum).

c. Electrical Power Distribution.
In order to reduce line losses which occur at lower voltages, power should be distributed at the highest practical voltages. Substation transformers should be located throughout the school to reduce the voltage to 277/480 volts for fluorescent lighting, heavy equipment operation, and power distribution. A second set of transformers should be provided to step the voltage from 480 to 120/208 for convenience outlets. Primary electric service should be underground from the nearest pole or manhole to a pad mounted transformer(s) located outdoors below grade, and as close to the load centers as practicable. Secondary electric service from transformer(s) should also be underground. Service and distribution equipment should be of the circuit breaker or fusible switch type, and branch circuit panelboards should be of the circuit breaker type. Shallow closets should be provided for electrical, telephone and auxiliary system equipment, where required. Distribution of power within the building should be in trenches or overhead raceways located to afford maximum flexibility in room power requirements and ready accessibility for circuit revisions.

d. Emergency Lighting.
Illuminated exit signs and emergency lights must be provided for all emergency exits and passageways as required by the NFPA Life Safety Code No. 101.

e. Telephone System.
Building telephone service should be underground with main terminal cabinets located in mechanical or electrical equipment rooms. Telephones and lines will be provided by the local Communications-Electronics Officer. However, the building must include outlets in key areas, identified in Chapter 3, including areas reserved for public telephones. Placement of outlets and empty telephone raceway systems must be designed in conjunction with the building design, and coordinated with the local Communications-Electronics Officer. Evidence of such coordination should be provided in the project design analysis.

f. Intercom/PA Systems.
An intercommunication system must be provided, consisting of a master station capable of selectively paging through individual loudspeakers in selected areas and offices. The loudspeaker stations should be the talk-back type, and include a conveniently located master station call button. The master station should have volume controls on input and output, an all-call feature, and indicators for announcing incoming calls. Speakers should be the flush-mounted type. Medium and large size classrooms must be furnished with receptacle and wiring for microphones and speakers for amplified audio distribution.

A class bell system may be incorporated into the public address system.

g. Central Television System.
A central television antenna system may be required. Antenna outlets should be located adjacent to convenience outlets in classrooms and lounges. Conduit, terminal box, outlet and junction box locations and sizes; the choice of using either CATV or MATV system facilities, or the provision of a complete local-building-type antenna system, must be coordinated with the local Communications-Electronics Officer at the earliest practicable phase of design. Where a non-government owned antenna system is to be utilized, built-in system features such as empty conduits and pull wires, terminal cabinets, and antenna outlets only will be provided with project funds.

h. Special Features.
Special receptacles for teaching equipment and task lights, lights with dimmers and lights for platform illumination shall be provided in classrooms as required by the using agency. Other features, such as a central information phone to orient the physically handicapped, may also be required.

Computer-controlled and electronic training equipment may require special environments. Refer to equipment manuals to establish criteria and specifications for radio frequency shielding, thermal conditions, signal grounding, and power fluctuations.

i. Specifications.
Applicable CE guide specifications include the CE 303 series.

(7) Fire Safety.

a. Criteria.
Criteria for fire protection, including fire and/or smoke detection systems, fire alarm and evacuation signal systems, and extinguishment systems, are prescribed in
MIL-HDBK-1OO8A,
AEI - Design Criteria, TM 5-812-2 and TM 5-813-6. These are generally based on the National Fire Code.

Because of the large size and occupancy, as well as the nature of equipment contained in many schools, fire safety will impact heavily on the organization and design of the buildings. The area limitations, length of corridors, size of rooms and exits must conform to the requirements for "flexible plan" buildings given in the National Fire Protection Association Code NFPA 101. Single-line plans showing fire-rated construction, location of detection and alarm systems, the location of exists and evacuation routes, areas where sprinkler and/or extinguishing systems are provided, and the location of other fire protection features must be included in project design analyses and completion records. The fire safety design should also be coordinated with the installation fire marshall.

b. Automatic Sprinkler Systems.
Automatic sprinkler systems must be provided:

- In all portions of educational buildings located below the floor of exit.
- In all windowless classrooms, shops and educational spaces not having exits leading directly to the outside.
- In all shops and classrooms in which hazardous materials are handled.

c. Extinguishing Systems.
Special extinguishing systems may be provided for protection of specific occupancies where such systems are determined to be the most feasible and effective.

d. Protection of Special Devices.
Space where special electrical or mechanical devices such as computers, simulators, etc., are to be housed must be identified and extinguishment systems designed accordingly.

e. Specifications.
Applicable CE guide specifications include CE 710.03 for fire alarm and evacuation signal systems, and CE 700 for sprinkler systems.

(8) Drawings.
Design drawings should show as a minimum, floor plans indicating functional layouts with all rooms and spaces dimensioned, elevations indicating type and extent of exterior building finishes, cross-sections with floor to floor heights dimensioned, specification of materials and methods of construction, design of electrical, mechanical and structural systems, communications and fire safety design, and interior designs with schedules of finish materials.

D. Interior Design

(1) References.
Final selection of equipment and furnishings must be based on the 1391 estimate and Project Development Brochure completed during planning as discussed under paragraph 2-3d. All items of equipment and furnishings which are permanently built-in or attached to the structure, as defined in AR 415-17, are considered part of the building. Other items which are loose, portable or can be detached from the structure without tools, are generally provided by the using service under separate contract.

DG 1110-3-122 shall be used as guidance in the development of the project. During final selection, preliminary schedules should be reviewed carefully, coordinated again with the local using service, and verified against the latest mandatory source catalogs.

(2) Selection Factors.

a. Appearance.
Furniture is an integral part of the overall building design and should be closely coordinated with the selection of colors and finish materials for consistency in appearance and quality. Clear relationship between the furnishings finish schedule and the building finish materials should be evident.

Chapter 4 of this guide gives the school planner information useful for selecting furniture. Color and finishes are included with overall color and texture schemes (Appendix A). Other characteristics are covered within space types for furniture appropriate to it. The Directorate of Information Office (DIO) can help the school planner find out what furniture is available to the school. DIO maintains a current list of Government contractors for furniture items, and may have or can obtain contractor's catalogs.

b. Durability, Comfort and Safety.
Careful attention must be given to all interior furnishings to insure that the type of furniture chosen conforms to standards of durability, comfort and safety appropriate for the use they will receive. Being generally mobile, furniture items are subject to handling. parts that receive the most wear should be replaceable, and finishes should sustain regular cleaning. Colors, textures, sizes, proportions, shapes and reflections are important comfort factors that should be considered. Furniture and equipment must withstand loading conditions without damage. Edges and surfaces should be smooth and rounded. Materials must be flame-retardant.

c. Mobility and Interchangeability.
Most interior furnishings should not be of a scale which would require more than two persons to relocate them, or be so complicated as to require an undue amount of time to assemble or disassemble.

Whenever possible, care should be taken to choose multi-purpose furnishings aesthetically suitable for a variety of needs and activities. Stackable and foldable furniture should be considered for reducing bulkiness in storage and transport where such requirements exist.

(3) Drawings and Schedules.
Furnishing layouts and schedules must indicate items which are part of the building and items which must be procured under separate contract. Drawings and schedules must be in formats that can be readily understood by installation personnel who are responsible for procurement and component placement and utilization after delivery. Display sheets consisting of placement plans, catalog illustrations, material/color samples and perspective sketches of typical spaces, together with procurement lists, source data and cost estimates should be developed as appropriate to accomplish this objective.

2-5 Provision of User Information

A. Requisites.
The completion records required upon completion of a building project are delineated in AR 415-10.

Additional requirements for user information are established in ER 1110-345-700, Design Analysis. The user information supplement to the completion records must include information on how to best utilize the facility design. Information must be presented in a form that facilitates understanding and use by using service personnel and Facilities Engineer personnel.

B. Site Design Information.
An activity layout plan should be provided to show the operational aspects of using the site, along with a discussion of the parking and traffic loads (with notation concerning sources and dates of traffic studies conducted), intended procedures for snow and trash removal, grounds control and security operations, and provisions for future expansion of parking, buildings, utilities, streets, etc. Aspects of planting care with a program for feeding and maintenance is also recommended.

C. Building Design Information.
This should include an activity layout plan along with a discussion of methods for altering partition systems and environmental systems, restrictions and maintenance required by fire safety regulations, intended levels of operation and control of environmental systems, necessary security and safety procedures, and aspects of housekeeping and maintenance. Fire safety plans and protective construction plans should also be provided along with a description and/or plan of features for the physically handicapped.

D. Technical Information.
All technical information available from manufacturers of the materials, equipment and accessories incorporated in the facility, will be provided to facilitate successful maintenance and operation of the facility. Similar information on special equipment and furnishings should also be provided.